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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/854,206	05/11/2001	David S. Pecora	00-0737.00/US	7849

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EXAMINER

TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08/19/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/854,206

Applicant(s)

PECORA, DAVID S.

Examiner

Binh X Tran

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 7-24-2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1, 8-9 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claims 1, 8-9, the examiner cannot find support in the specification for the negative limitation "in the absence of a photoresist layer". Any negative limitation or exclusionary proviso must have basis in the original disclosure. The mere absence of a positive recitation is not basis for an exclusion. Any claim containing a negative limitation which does not have basis in the original disclosure should be rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement (MPEP 2173.05(i)).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

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(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

4. Claim 8 is rejected under 35 U.S.C. 102(e) as being anticipated by Pradeep et al. (US 6,337,262).

Pradeep discloses a method for etching a silicon nitride layer comprising:

providing a semiconductor wafer assembly comprising a silicon wafer (10) and a layer of silicon dioxide (12) overlying the wafer;

forming a silicon nitride layer (14) over said silicon wafer and over said layer of silicon dioxide (Fig 1);

placing the semiconductor wafer assembly into an etch chamber;

etching the silicon nitride after the photoresist (16) is removed (read on "in the absence of a photoresist layer) using an etch gas consisting essentially of oxygen and CH_3F at the pressure of 50-60 mTorr (read on applicant's range of 10-60 mTorr) to expose the silicon dioxide layer (col. 6 lines 1-10, Fig 4-5). The examiner clearly recognizes that Mao also teaches argon in the etching composition with oxygen and CHF_3 . However the examiner interprets the transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials steps "and those that do not materially affect the basic and novel characteristic(s)" of the claimed invention (See MPEP 2111.03). Since argon is an inert gas, therefore argon does not materially affect the basis and novel characteristics of the chemical etching process. Further it is known in the semiconductor art, that argon is used as a carrier gas for diluting the active

etchant concentration. Since argon is an inert gas, it cannot be an active component during chemical etching process.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Pradeep et al. (US 6,337,262) and further in view Bosch (US 5,626,716).

Pradeep discloses a method for etching a silicon nitride layer comprising:

etching the silicon nitride layer after the resist mask is removed in previous step (read on "in the absence of a photoresist layer) with an etching consisting essentially of oxygen and CH₃F at the pressure of 50-60 mTorr (within applicant's range of 10-60 mTorr; See Fig 4-5, col. 6 lines 1-7).

The examiner clearly recognizes that Pradeep also teaches argon in the etching composition with oxygen and CHF₃. However the examiner interprets the transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials steps "and those that do not materially affect the basic and novel characteristic(s)" of the claimed invention (See MPEP 2111.03). Since argon is an inert gas, therefore argon does not materially affect the basis and novel characteristics of the chemical etching process. Further it is known in the semiconductor art, that argon is used as a

carrier gas for diluting the active etchant concentration. Since argon is an inert gas, it cannot be an active component during chemical etching process.

Pradeep does not disclose the flow rate of CHF_3 and oxygen. In a method for etching silicon nitride, Bosch discloses the flow rate of CHF_3 equal 10-20 sccm (within applicant's range of 20-80 sccm) and the flow rate of oxygen equal 70-110 sccm (within applicant's range of 20-80 sccm; See col. 6 lines 1-13).

It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Pradeep in view of Bosch by using the specific flow rate since Pradeep is not particular about the specific flow rate and therefore any flow rate would produce an expected result.

Claims 3-5 differ from Pradeep and Bosch by the specific flow rate value, power value. However Bosch clearly discloses the power is a result effective variable by that the higher the power, the faster the etching rate (col. 5). Bosch further suggests to varying the value of the power and flow rate within a certain range. The result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to produce an expected result.

7. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuo et al. (US 5,994,227) in view Campbell et al. (US 5,994,227).

Matsuo discloses a method for etching a silicon nitride layer comprising:

etching the silicon nitride layer after the resist mask is removed in previous step (read on "in the absence of a photoresist layer) with an etching consisting essentially of oxygen and CH_2F_2 (See Fig 3-5, col. 3 lines 5-8, col. 3 lines 25-50).

Claim 1 differs from Matsuo by the specific flow rate and pressure. However, Matsuo discloses that the mixture ratio of oxygen and CH_2F_2 is a result effective variable (Fig 6). Since mixture ratio is the result effective variable, the flow rate of individual oxygen and CH_2F_2 must be a result effective variable because the mixture ratio depends on flow rate of oxygen divided and the flow rate of CH_2F_2 . In a silicon nitride etching process, Campbell discloses that pressure is the result effective variable (Fig 12, Table 1). The result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal value as an expected result.

Respect to claim 2, Matsuo does not explicitly disclose the ratio of oxygen to CH_2F_2 is about 3:1. However, Matsuo clearly discloses the mixture ratio in percentage of oxygen as an effective ratio (Fig 6). Any person having ordinary skill in the art would be able to convert the mixture ratio in percentage to the mixture ratio in fraction. Further, the result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been

obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal value as an expected result

Claims 3-7 differ from the cited prior art by the specific value of power, flow rate of CH_2F_2 and oxygen. The limitation regarding the specific flow rate of has been discussed in previous paragraphs. Campbell discloses that power is the result effective variable during the etching process by varying the power from 0 Watt to 3 KW (Fig 11, read on applicant's range of 300-600 Watts or 300-400 Watts). The result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal value as an expected result.

Respect to claim 8-9 Matsuo discloses:

providing a semiconductor wafer assembly comprising a semiconductor substrate (30) and a layer a silicon dioxide overlying the wafer (Fig 1, col. 2 lines 57-67);

forming a silicon nitride (5) over the semiconductor substrate (30) and the silicon dioxide layer;

placing the semiconductor wafer assembly into an etch chamber;

etching the silicon nitride layer after the resist mask is removed in previous step (read on "in the absence of a photoresist layer) with an etching consisting essentially of oxygen and CH_2F_2 (See Fig 3-5, col. 3 lines 5-8, col. 3 lines 25-50) to expose the

semiconductor substrate and the silicon dioxide layer (aka silicon oxide layer, See Fig 4 and/or Fig 9) .

Matsuo does not disclose the semiconductor substrate is silicon. However the use of silicon is well known the semiconductor art (See Bosch with the silicon substrate 10).

Claims 8-9 differ from the cited prior by the specific value of pressure. This limitation has been discussed in previous paragraph. The limitation of dependent claims 10-16 is identical with the limitation of dependent claims 2-7 which already discussed in previous paragraph.

Response to Arguments

8. Applicant's arguments filed 7-24-2002 have been fully considered but they are not persuasive. The applicant argues that the language of the present claim 1,8-9 "consisting essentially of oxygen... and one of CHF_3 and CH_2F_2 " is novel over some prior art with have argon gas. The examiner disagrees. First there is no limitation in the claim, which explicitly excludes argon. Second, the applicants claim "A method ... comprising" (emphasis added) in claims 1, 8-9. The transitional term "comprising" is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. "Comprising" is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim. The term "comprising" leaves the claim open for the inclusion of unspecified ingredients even in major amounts (See MPEP 2111.03). Third

the examiner considers the argon gas as an inert gas, thus argon does not materially affect the basis and novel characteristics of the chemical etching process.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yang et al. (US 6,162,583) discloses etching silicon nitride layer using CHF₃ as an active ingredient and argon as a carrier gas (col. 6).

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (703) 308-1867. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Binh X. Tran
August 15, 2002


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